

Doc. Number :

- Tentative Specification
 Preliminary Specification
 Approval Specification

MODEL NO.: M270HHF
SUFFIX: L10

Customer:**APPROVED BY****SIGNATURE****Name / Title**

Note

Product Version C1

Please return 1 copy for your confirmation with your signature and comments.

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CONTENTS

1. GENERAL DESCRIPTION	5
1.1 OVERVIEW	5
1.2 GENERAL SPECIFICATIONS	5
2. MECHANICAL SPECIFICATIONS	5
3. ABSOLUTE MAXIMUM RATINGS	6
3.1 ABSOLUTE RATINGS OF ENVIRONMENT	6
3.2 ELECTRICAL ABSOLUTE RATINGS	6
3.2.1 TFT LCD MODULE	6
3.2.2 BACKLIGHT UNIT	7
4. ELECTRICAL SPECIFICATIONS	7
4.1 FUNCTION BLOCK DIAGRAM	7
4.2. INTERFACE CONNECTIONS	8
4.2.1 51PIN CONNECTOR PIN ASSIGNMENT	8
4.3 ELECTRICAL CHARACTERISTICS	12
4.3.1 LCD ELETRONICS SPECIFICATION	12
4.3.2 BACKLIGHT UNIT	14
4.3.3 LIGHTBAR Connector Pin Assignment	15
4.4 LVDS INPUT SIGNAL SPECIFICATIONS	16
4.4.1 LVDS DATA MAPPING TABLE	16
4.4.2 COLOR DATA INPUT ASSIGNMENT	17
4.5 DISPLAY TIMING SPECIFICATIONS	18
4.5.1 INPUT SIGNAL TIMING SPECIFICATIONS	18
4.5.2 TIMING SPEC FOR FRAME RATE (Fr5 = 100Hz)	18
4.5.3 TIMING SPEC FOR FRAME RATE (Fr6 = 120Hz)	19
4.6 POWER ON/OFF SEQUENCE	21
4.6.1 POWER ON/OFF SEQUENCE (Ta = 25 ± 2 °C)	21
4.6.2 2D to 3D SIGNAL SEQUENCE WITHOUT VCC TURN OFF AND TURN ON	22
5. OPTICAL CHARACTERISTICS	23
5.1 TEST CONDITIONS	23
5.2 OPTICAL SPECIFICATIONS	23
6. RELIABILITY TEST ITEM	26
7. PACKING	27
7.1 PACKING SPECIFICATIONS	27
7.2 PACKING METHOD	27
7.3 PALLET	28

8. CMI MODULE LABEL	29
9. PRECAUTIONS	30
9.1 ASSEMBLY AND HANDLING PRECAUTIONS.....	30
9.2 STORAGE PRECAUTIONS.....	30
9.3 OPERATION PRECAUTIONS	30
9.4 SAFETY PRECAUTIONS	31
9.5 SAFETY STANDARDS	31
9.6 OTHER	31
Appendix. OUTLINE DRAWING	31

REVISION HISTORY

1. GENERAL DESCRIPTION

1.1 OVERVIEW

The M270HHF-L10 model is a 27.0" wide TFT-LCD module with a WLED Backlight Unit and 51/41-pin 4ch-LVDS interface. This module supports 1920 x 1080 Full HD mode and displays up to 16.7 million colors. The converter module for the Backlight Unit is not built in.

1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	27.0" real diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1920 x R.G.B. x 1080	pixel	-
Pixel Pitch	0.2715 (H) x 0.2715 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	AG type, 3H hard coating, Haze 25	-	-
TCO	TCO 5.0 compliance		
Luminance, White	300	Cd/m ²	
Color Gamut	72% of NTSC(Typ.)	-	-
Power Consumption	Total (17.8) W (Typ.) @ cell (5.5) W (Typ.), BL (12.3) W (Typ.)	(1)	

Note (1) The specified power consumption : Total= cell (reference 4.3.1)+BL (reference 4.3.3)

2. MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	629.5	630	631.5	(1)
	Vertical (V)	367.7	368.2	368.7	
	Thickness (T)	15.4	15.9	16.4	
Bezel Area	Horizontal	603.41	603.91	604.41	
	Vertical	341.79	342.29	342.79	
Active Area	Horizontal	-	597.888	-	
	Vertical	-	336.312	-	
Weight	-	2990	3110	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

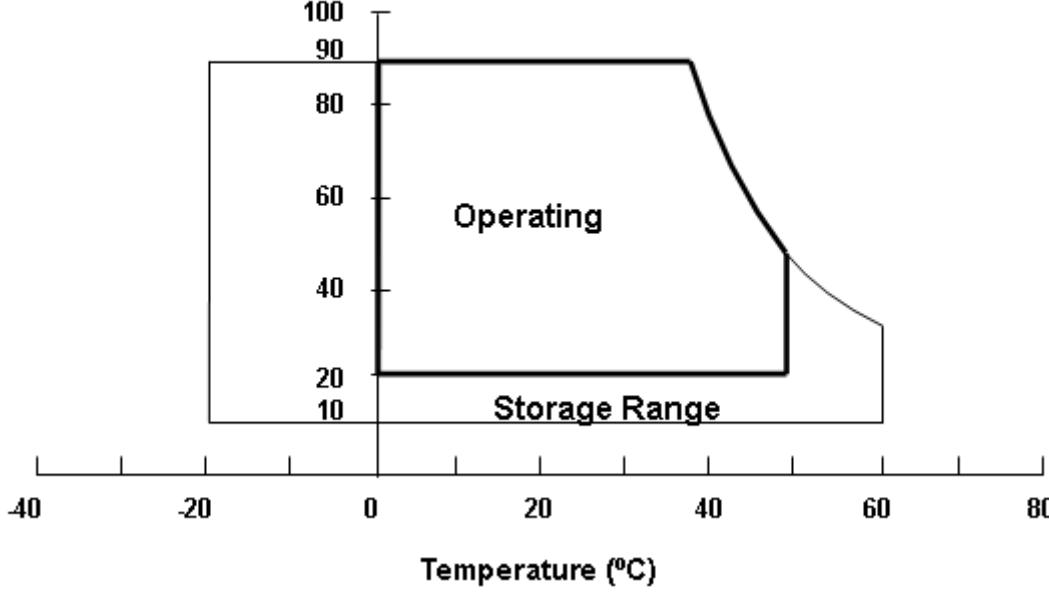
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	60	°C	(1)
Operating Ambient Temperature	TOP	0	50	°C	(1), (2)

Note (1)

- (a) 90 %RH Max. ($T_a \leq 40^{\circ}\text{C}$).
- (b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40^{\circ}\text{C}$).
- (c) No condensation.

Note (2) The temperature of panel surface should be 0 °C min. and 60 °C max.

Relative Humidity (%RH)



3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	12.6	V	(1)
Logic Input Voltage	VIN	-0.3	3.6	V	

3.2.2 BACKLIGHT UNIT

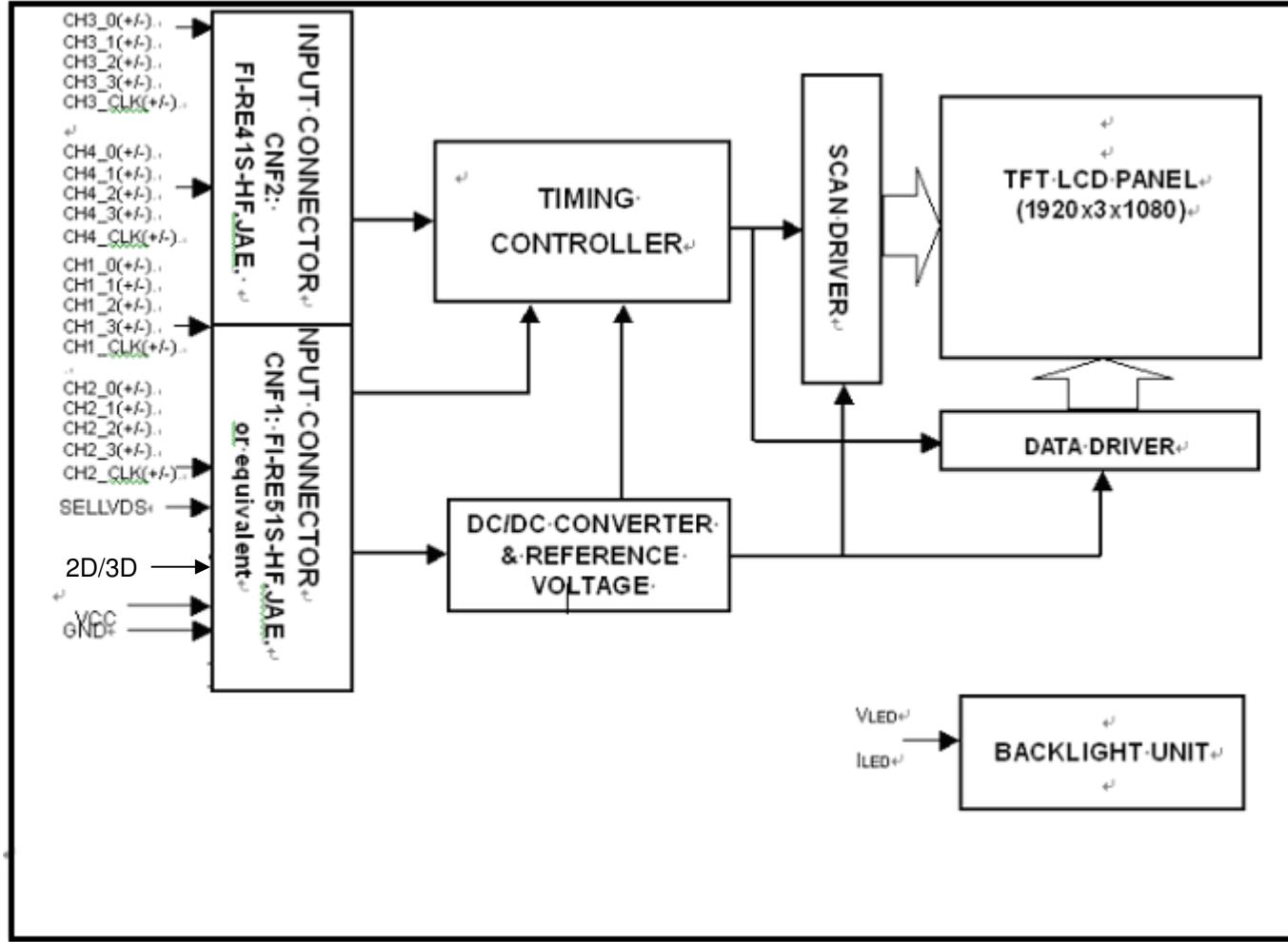
Item	Symbol	Value			Unit	Note
		Min.	Typ	Max.		
LED Forward Current Per Input Pin	IF	---	100	112	mA	(1), (2) Duty=100%
LED Reverse Voltage Per Input Pin	VR	---	---	70	V	
LED Pulse Forward Current Per Input Pin	IP	---	---	320	mA	(1), (2) Pulse Width \leq 10msec. and Duty \leq 10%

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for input pin of LED light bar at $T_a=25\pm 2$ °C (Refer to 4.3.3 and 4.3.4 for further information).

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



4.2. INTERFACE CONNECTIONS

4.2.1 51PIN CONNECTOR PIN ASSIGNMENT

CNF1 Connector Pin Assignment: (FI-RE51S-HF(JAE) or equivalent)

Pin	Name	Description	Note
1	N.C.	No Connection	(1)
2	N.C.	No Connection	
3	N.C.	No Connection	
4	N.C.	No Connection	
5	N.C.	No Connection	
6	N.C.	No Connection	
7	SELLVDS	LVDS Data Format Selection	(2)(3)
8	N.C.	No Connection	(1)
9	N.C.	No Connection	
10	N.C.	No Connection	
11	GND	Ground	
12	CH1[0]-	First pixel Negative LVDS differential data input. Pair 0	
13	CH1[0]+	First pixel Positive LVDS differential data input. Pair 0	
14	CH1[1]-	First pixel Negative LVDS differential data input. Pair 1	
15	CH1[1]+	First pixel Positive LVDS differential data input. Pair 1	
16	CH1[2]-	First pixel Negative LVDS differential data input. Pair 2	
17	CH1[2]+	First pixel Positive LVDS differential data input. Pair 2	
18	GND	Ground	
19	CH1CLK-	First pixel Negative LVDS differential clock input.	
20	CH1CLK+	First pixel Positive LVDS differential clock input.	
21	GND	Ground	
22	CH1[3]-	First pixel Negative LVDS differential data input. Pair 3	
23	CH1[3]+	First pixel Positive LVDS differential data input. Pair 3	
24	N.C.	No Connection	
25	N.C.	No Connection	
26	2D/3D	Input signal for 2D/3D Mode Selection	(5)(6)
27	N.C.	No Connection	
28	CH2[0]-	Second pixel Negative LVDS differential data input. Pair 0	
29	CH2[0]+	Second pixel Positive LVDS differential data input. Pair 0	
30	CH2[1]-	Second pixel Negative LVDS differential data input. Pair 1	
31	CH2[1]+	Second pixel Positive LVDS differential data input. Pair 1	
32	CH2[2]-	Second pixel Negative LVDS differential data input. Pair 2	
33	CH2[2]+	Second pixel Positive LVDS differential data input. Pair 2	
34	GND	Ground	
35	CH2CLK-	Second pixel Negative LVDS differential clock input.	
36	CH2CLK+	Second pixel Positive LVDS differential clock input.	
37	GND	Ground	
38	CH2[3]-	Second pixel Negative LVDS differential data input. Pair 3	
39	CH2[3]+	Second pixel Positive LVDS differential data input. Pair 3	
40	N.C.	No Connection	
41	N.C.	No Connection	
42	NC	No Connection	
43	N.C.	No Connection	(1)
44	GND	Ground	
45	GND	Ground	
46	GND	Ground	
47	N.C.	No Connection	(1)

48	VCC	+12V power supply	
49	VCC	+12V power supply	
50	VCC	+12V power supply	
51	VCC	+12V power supply	

Note : Connector Part No.:FI-RE51S-HF,(JAE)

CNF2 Connector Pin Assignment (FI-RE41S-HF (JAE) or equivalent)

Pin	Name	Description	Note
1	N.C.	No Connection	(1)
2	N.C.	No Connection	
3	N.C.	No Connection	
4	N.C.	No Connection	
5	N.C.	No Connection	
6	N.C.	No Connection	
7	N.C.	No Connection	
8	N.C.	No Connection	
9	GND	Ground	
10	CH3[0]-	Third pixel Negative LVDS differential data input. Pair 0	
11	CH3[0]+	Third pixel Positive LVDS differential data input. Pair 0	
12	CH3[1]-	Third pixel Negative LVDS differential data input. Pair 1	
13	CH3[1]+	Third pixel Positive LVDS differential data input. Pair 1	
14	CH3[2]-	Third pixel Negative LVDS differential data input. Pair 2	
15	CH3[2]+	Third pixel Positive LVDS differential data input. Pair 2	
16	GND	Ground	
17	CH3CLK-	Third pixel Negative LVDS differential clock input.	
18	CH3CLK+	Third pixel Positive LVDS differential clock input.	
19	GND	Ground	
20	CH3[3]-	Third pixel Negative LVDS differential data input. Pair 3	
21	CH3[3]+	Third pixel Positive LVDS differential data input. Pair 3	
22	N.C.	No Connection	
23	N.C.	No Connection	
24	GND	Ground	
25	GND	Ground	
26	CH4[0]-	Fourth pixel Negative LVDS differential data input. Pair 0	
27	CH4[0]+	Fourth pixel Positive LVDS differential data input. Pair 0	
28	CH4[1]-	Fourth pixel Negative LVDS differential data input. Pair 1	
29	CH4[1]+	Fourth pixel Positive LVDS differential data input. Pair 1	
30	CH4[2]-	Fourth pixel Negative LVDS differential data input. Pair 2	
31	CH4[2]+	Fourth pixel Positive LVDS differential data input. Pair 2	
32	GND	Ground	
33	CH4CLK-	Fourth pixel Negative LVDS differential clock input.	
34	CH4CLK+	Fourth pixel Positive LVDS differential clock input.	
35	GND	Ground	
36	CH4[3]-	Fourth pixel Negative LVDS differential data input. Pair 3	
37	CH4[3]+	Fourth pixel Positive LVDS differential data input. Pair 3	
38	N.C.	No Connection	
39	N.C.	No Connection	
40	GND	Ground	
41	GND	Ground	

Note : Connector Part No.: FI-RE41S-HF,(JAE)

Note (1) Reserved for internal use. Please leave it open.

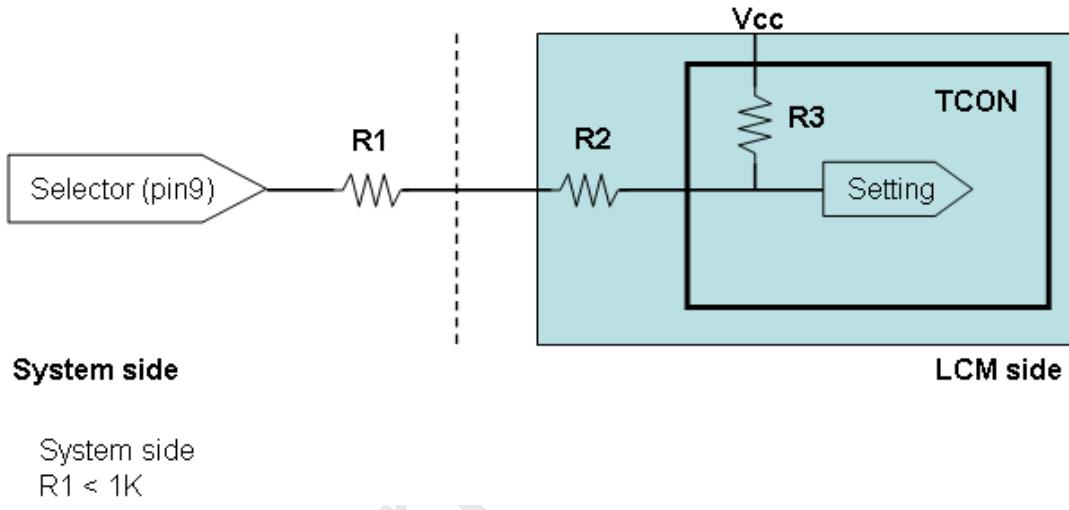
Note (2) LVDS format selection.

L= Connect to GND , H=Connect to +3.3V or Open

SELLVDS	Note
L	JEDIA Format
H or Open	VESA Format

Note (3) SELLVDS signal pin connected to the LCM side has the following diagram.

R1 in the system side should be less than 1K Ohm. ($R1 < 1K$ Ohm)



System side
 $R1 < 1K$

Note (4) LVDS 4-port Data Mapping

Port	Channel of LVDS	Data Stream
1st Port	First Pixel	1, 5, 9,1913, 1917
2nd Port	Second Pixel	2, 6, 10,1914, 1918
3rd Port	Third Pixel	3, 7, 11,1915, 1919
4th Port	Fourth Pixel	4, 8, 12,1916, 1920

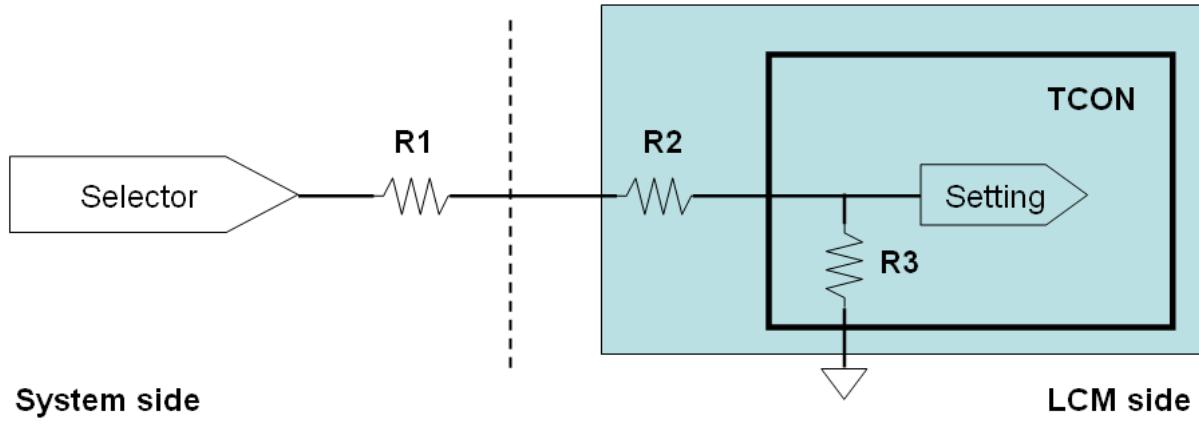
Note (5) 2D/3D mode selection.

L= Connect to GND or Open, H=Connect to +3.3V

2D/3D	Note
L or Open	2D Mode
H	3D Mode

Note (6) 2D/3D signal pin connected to the LCM side has the following diagram.

R1 in the system side should be less than 1K Ohm. ($R1 < 1K$ Ohm)



System side: $R1 < 1K$

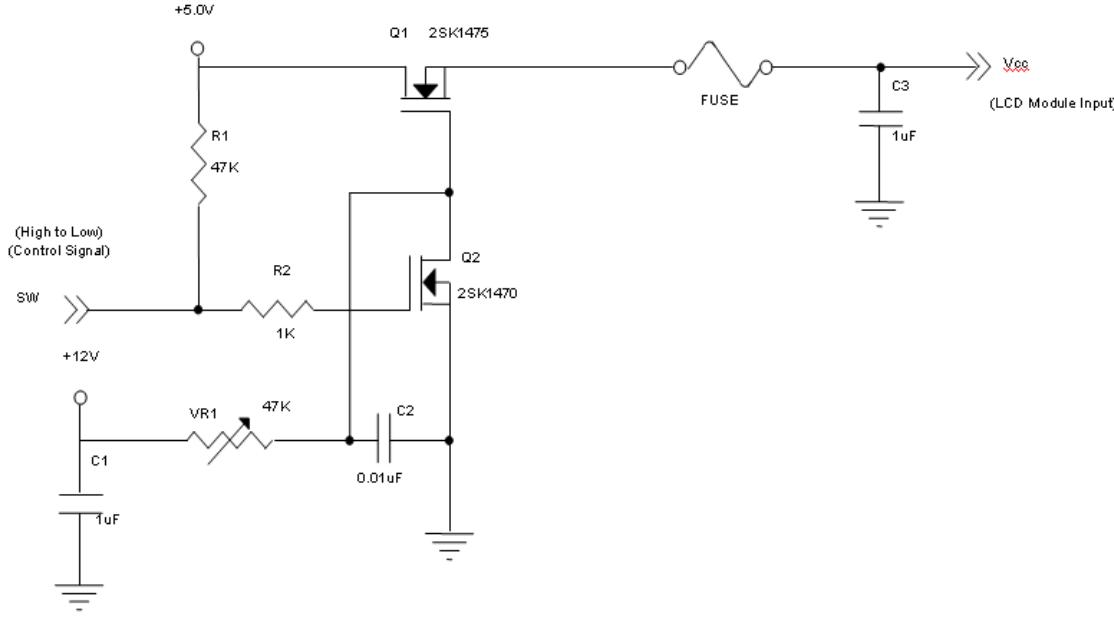
4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELECTRONICS SPECIFICATION

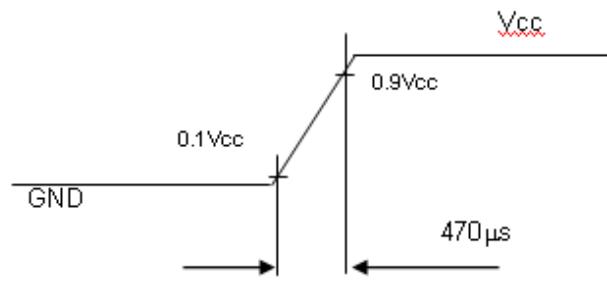
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V_{CC}	10.8	12	12.6	V	(1)
Rush Current	I_{RUSH}	—	—	(3.8)	A	(2)
Power Consumption	White Pattern	—	—	3	4.2	(3)
	Horizontal Stripe	—	—	7.92	11.2	
	Black Pattern	—	—	8.16	11.6	
Power Supply Current	White Pattern	—	—	0.25	0.35	(3)
	Horizontal Stripe	—	—	0.66	0.93	
	Black Pattern	—	—	0.68	0.96	
LVDS interface	Differential Input High Threshold Voltage	V_{LVTH}	+100	—	—	mV
	Differential Input Low Threshold Voltage	V_{LVTL}	—	—	-100	mV
	Common Input Voltage	V_{CM}	1.0	1.2	1.4	V
	Differential input voltage (single-end)	$ V_{ID} $	200	—	600	mV
	Terminating Resistor	R_T	—	100	—	ohm
CMIS interface	Input High Threshold Voltage	V_{IH}	2.7	—	3.3	V
	Input Low Threshold Voltage	V_{IL}	0	—	0.7	V

Note (1) The module should be always operated within the above ranges.

Note (2) Measurement condition:



V_{cc} rising time is 470μs



Note (3) The specified power consumption and power supply current is under the conditions at $V_{cc} = 12$ V, $T_a = 25 \pm 2$ $^{\circ}C$, $f_v = 120$ Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



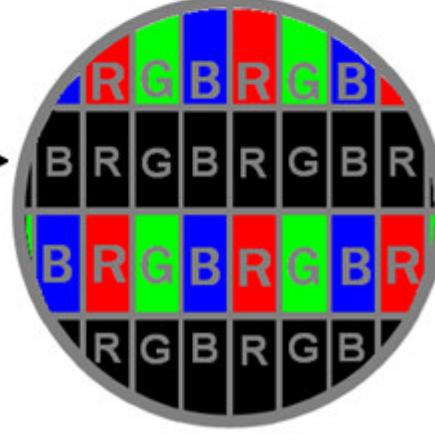
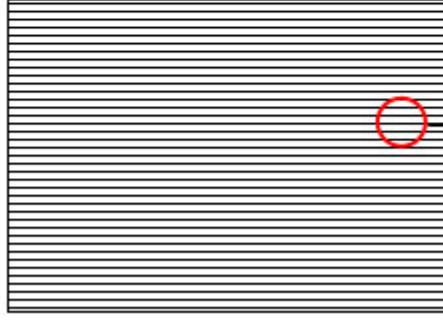
Active Area

b. Black Pattern

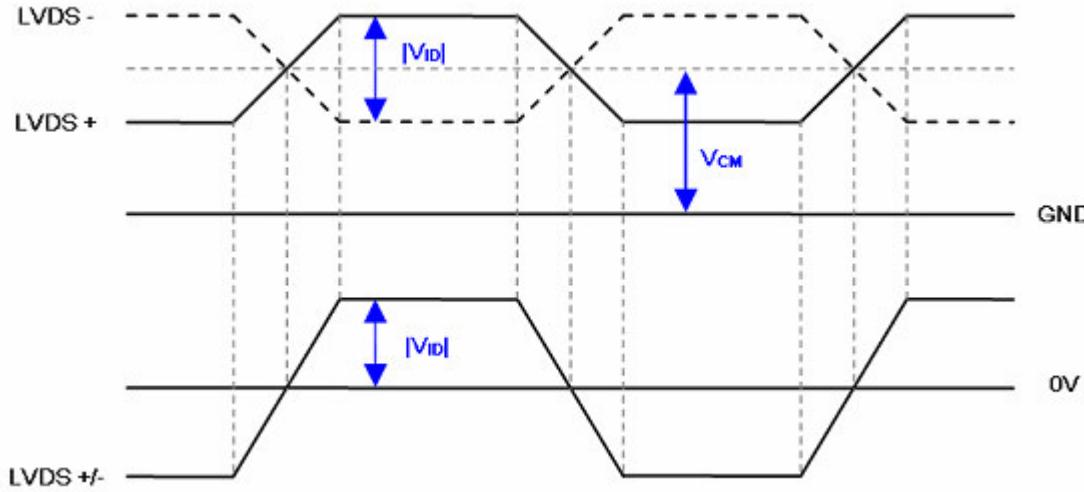


Active Area

c. Horizontal Stripe Pattern



Note (4) The LVDS input characteristics are as follows:



4.3.2 BACKLIGHT UNIT

Normal mode

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Input Voltage Per Input Pin	VLED	(39.2)	(44.8)	(47.6)	V	(1), Duty=100%, ILED=100mA
LED Light Bar Current Per Input Pin	ILED	-	(100)	-	mA	(1), (2) Duty=100%
LED Life Time	LLED	30000	-	-	Hrs	(3)
Power Consumption	PBL	---	(17.92)	-	W	(1) Duty=100%, ILED=100mA

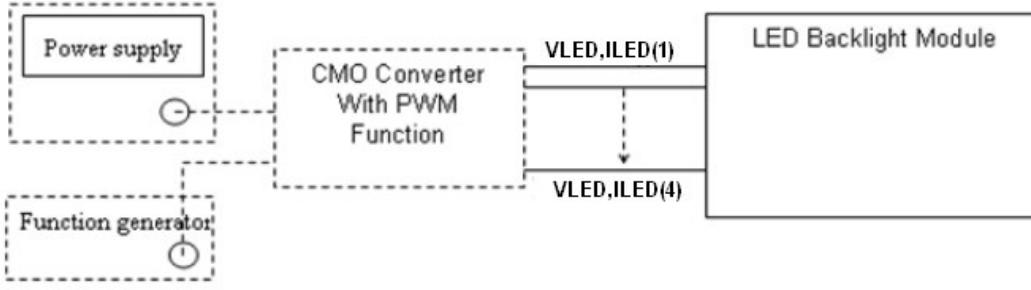
Peaking mode(reference only)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Input Voltage Per Input Pin	VLED	---	49	---	V	(1), Duty=100%, ILED=(100)mA
LED Light Bar Current Per Input Pin	ILED	---	160	---	mA	(1), (2) Duty=(18)%
LED Life Time	LLED	30000	---	---	Hrs	(3)
Power Consumption	PBL	---	5.64	---	W	(1) Duty=(18)%, ILED=(100)mA

Note (1) LED light bar input voltage and current are measured by utilizing a true RMS multimeter as shown below:

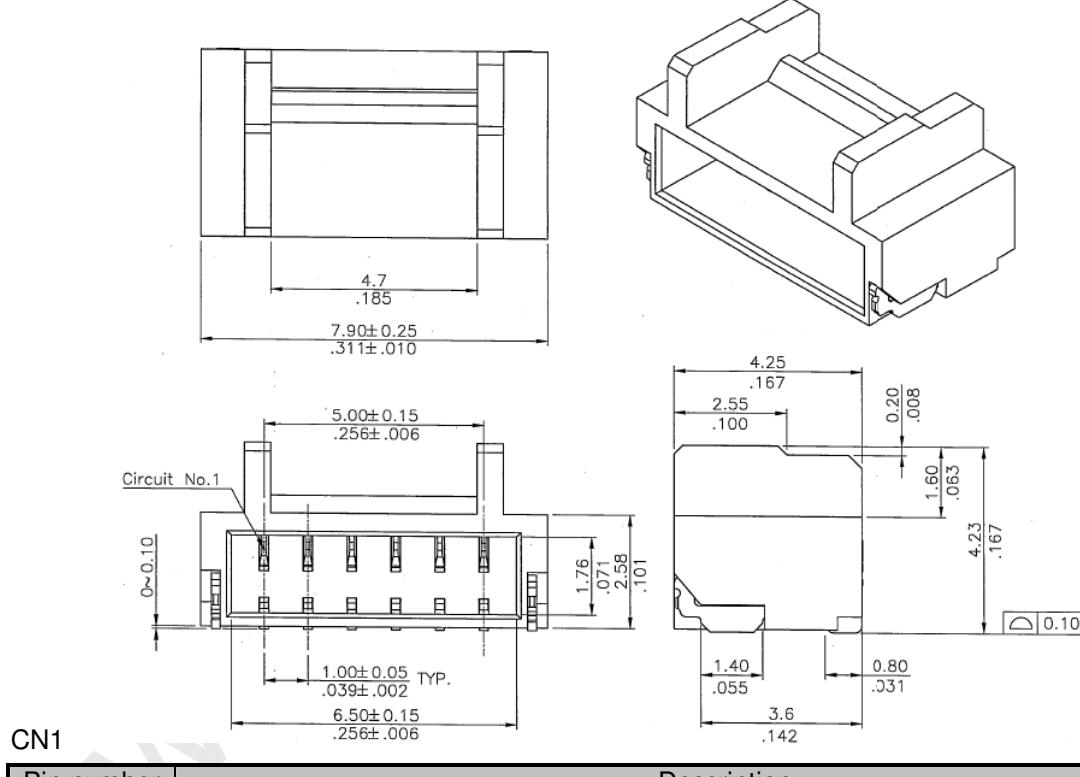
Note (2) $PBL = ILED \times VLED \times (4)$ input pins.

Note (3) The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at $T_a = 25 \pm 2^\circ C$ and $I = (25)mA$ (per chip) until the brightness becomes $\leq 50\%$ of its original value.



4.3.3 LIGHTBAR Connector Pin Assignment

Connector: CI1406M1HRF-NH or Compatible



CN1

Pin number	Description
1	Cathode of LED string
2	Cathode of LED string
3	VLED
4	VLED
5	Cathode of LED string
6	Cathode of LED string

Note (1) User's Mating Connector Part No.: CI1406SL000-NH (CviLux) or Compatible.

4.4 LVDS INPUT SIGNAL SPECIFICATIONS

4.4.1 LVDS DATA MAPPING TABLE

LVDS Channel O0 ⁺	LVDS output ⁺	D7 ⁺	D6 ⁺	D4 ⁺	D3 ⁺	D2 ⁺	D1 ⁺	D0 ⁺
	Data order ⁺	OG0 ⁺	OR5 ⁺	OR4 ⁺	OR3 ⁺	OR2 ⁺	OR1 ⁺	OR0 ⁺
LVDS Channel O1 ⁺	LVDS output ⁺	D18 ⁺	D15 ⁺	D14 ⁺	D13 ⁺	D12 ⁺	D9 ⁺	D8 ⁺
	Data order ⁺	OB1 ⁺	OB0 ⁺	OG5 ⁺	OG4 ⁺	OG3 ⁺	OG2 ⁺	OG1 ⁺
LVDS Channel O2 ⁺	LVDS output ⁺	D26 ⁺	D25 ⁺	D24 ⁺	D22 ⁺	D21 ⁺	D20 ⁺	D19 ⁺
	Data order ⁺	DE ⁺	NA ⁺	NA ⁺	OB5 ⁺	OB4 ⁺	OB3 ⁺	OB2 ⁺
LVDS Channel O3 ⁺	LVDS output ⁺	D23 ⁺	D17 ⁺	D16 ⁺	D11 ⁺	D10 ⁺	D5 ⁺	D27 ⁺
	Data order ⁺	NA ⁺	OB7 ⁺	OB6 ⁺	OG7 ⁺	OG6 ⁺	OR7 ⁺	OR6 ⁺
LVDS Channel E0 ⁺	LVDS output ⁺	D7 ⁺	D6 ⁺	D4 ⁺	D3 ⁺	D2 ⁺	D1 ⁺	D0 ⁺
	Data order ⁺	EG0 ⁺	ER5 ⁺	ER4 ⁺	ER3 ⁺	ER2 ⁺	ER1 ⁺	ER0 ⁺
LVDS Channel E1 ⁺	LVDS output ⁺	D18 ⁺	D15 ⁺	D14 ⁺	D13 ⁺	D12 ⁺	D9 ⁺	D8 ⁺
	Data order ⁺	EB1 ⁺	EB0 ⁺	EG5 ⁺	EG4 ⁺	EG3 ⁺	EG2 ⁺	EG1 ⁺
LVDS Channel E2 ⁺	LVDS output ⁺	D26 ⁺	D25 ⁺	D24 ⁺	D22 ⁺	D21 ⁺	D20 ⁺	D19 ⁺
	Data order ⁺	DE ⁺	NA ⁺	NA ⁺	EB5 ⁺	EB4 ⁺	EB3 ⁺	EB2 ⁺
LVDS Channel E3 ⁺	LVDS output ⁺	D23 ⁺	D17 ⁺	D16 ⁺	D11 ⁺	D10 ⁺	D5 ⁺	D27 ⁺
	Data order ⁺	NA ⁺	EB7 ⁺	EB6 ⁺	EG7 ⁺	EG6 ⁺	ER7 ⁺	ER6 ⁺

4.4.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color ^②		Data Signal ^③																						
		Red ^④								Green ^④						Blue ^④								
		R7	R6	R5	R4	R3	R2	R1	RO	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1
Basic Colors	Black ^⑤	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red ^⑤	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green ^⑤	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0
	Blue ^⑤	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan ^⑤	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta ^⑤	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow ^⑤	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
	White ^⑤	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gray	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Scale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Of	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(253)	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Gray	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Scale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Of	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0
	Green(253)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gray	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Scale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Of	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

4.5 DISPLAY TIMING SPECIFICATIONS

4.5.1 INPUT SIGNAL TIMING SPECIFICATIONS

(Ta = 25 ± 2 °C)

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	F _{clkin} (=1/TC)	60	74.25	96.23	MHz	
	Input cycle to cycle jitter	T _{rcl}	-	-	200	ps	(3)
	Spread spectrum modulation range	F _{clkin_mod}	F _{clkin} -2%	-	F _{clkin} +2%	MHz	(4)
	Spread spectrum modulation frequency	F _{SSM}	-	-	200	KHz	
LVDS Receiver Data	Setup Time	T _{lvsu}	600	-	-	ps	(5)
	Hold Time	T _{lvhd}	600	-	-	ps	

Note: Because this module is operated by DE only mode, Hsync and Vsync input signals are ignored.

4.5.2 TIMING SPEC FOR FRAME RATE (Fr5 = 100Hz)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Vertical Active Display Term	2D Mode	Total	T _v	1115	1125	1135	Th
		Display	T _{vd}	1080	1080	1080	Th
		Blank	T _{vbd}	35	45	55	Th
	3D Mode	Total	T _v	1524			Th
		Display	T _{vd}	1080			Th
		Blank	T _{vbd}	444			Th
Horizontal Active Display Term	2D Mode	Total	T _h	540	550	575	T _c
		Display	T _{hd}	480	480	480	T _c
		Blank	T _{hb}	60	70	95	T _c
	3D Mode	Total	T _h	525			T _c
		Display	T _{hd}	480			T _c
		Blank	T _{hb}	45			T _c

4.5.3 TIMING SPEC FOR FRAME RATE (Fr6 = 120Hz)

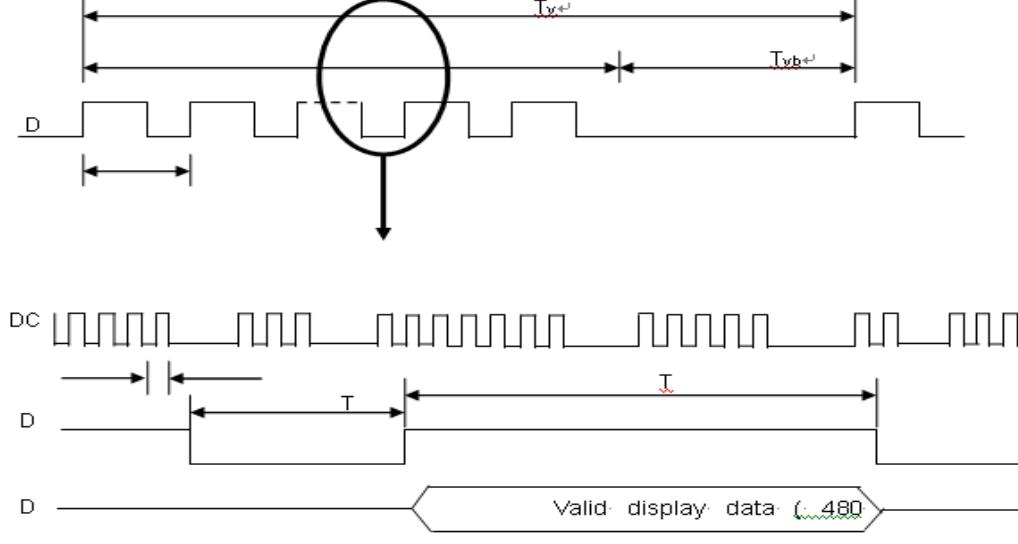
Signal	Item		Symbol	Min.	Typ.	Max.	Unit	Note
Vertical Active Display Term	2D Mode	Total	Tv	1115	1125	1135	Th	Tv=Tvd+Tvb
		Display	Tvd	1080	1080	1080	Th	—
		Blank	Tvb	35	45	55	Th	—
	3D Mode	Total	Tv	1524			Th	(6)
		Display	Tvd	1080			Th	
		Blank	Tvb	444			Th	
Horizontal Active Display Term	2D Mode	Total	Th	540	550	575	Tc	Th=Thd+Thb
		Display	Thd	480	480	480	Tc	—
		Blank	Thb	60	70	95	Tc	—
	3D Mode	Total	Th	525			Tc	(7)
		Display	Thd	480			Tc	
		Blank	Thb	45			Tc	

Note (1) Since the module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

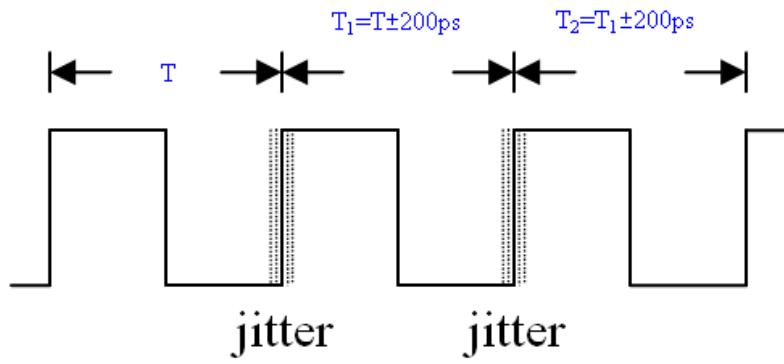
Note (2) Please make sure the range of pixel clock has follow the below equation:

$$F_{clock(max)} \geq Fr_6 \times Tv \times Th$$

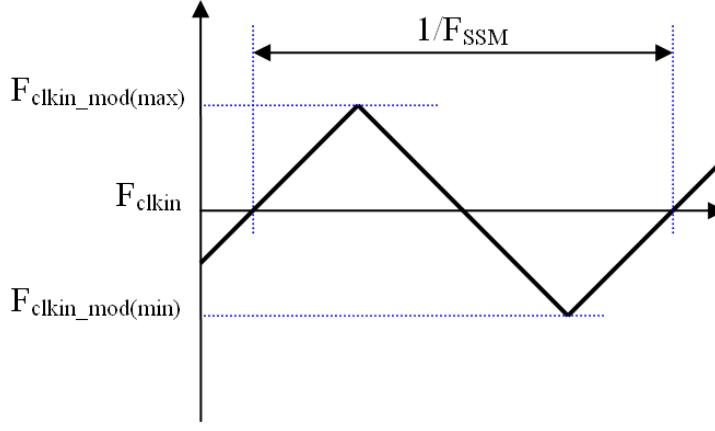
$$Fr_5 \times Tv \times Th \geq F_{clock(min)}$$

INPUT SIGNAL TIMING DIAGRAM

Note (3) The input clock cycle-to-cycle jitter is defined as below figures. $Trcl = |T_1 - T_2|$

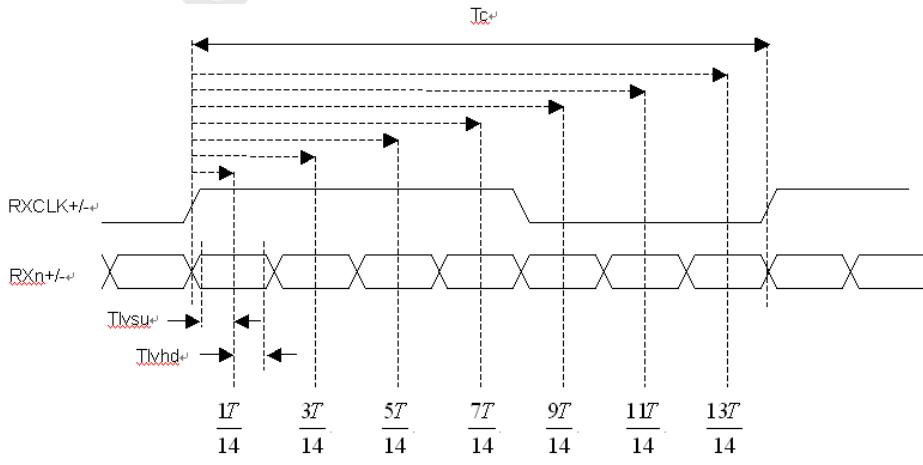


Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (5) The LVDS timing diagram and setup/hold time is defined and showing as the following figures.

LVDS RECEIVER INTERFACE TIMING DIAGRAM



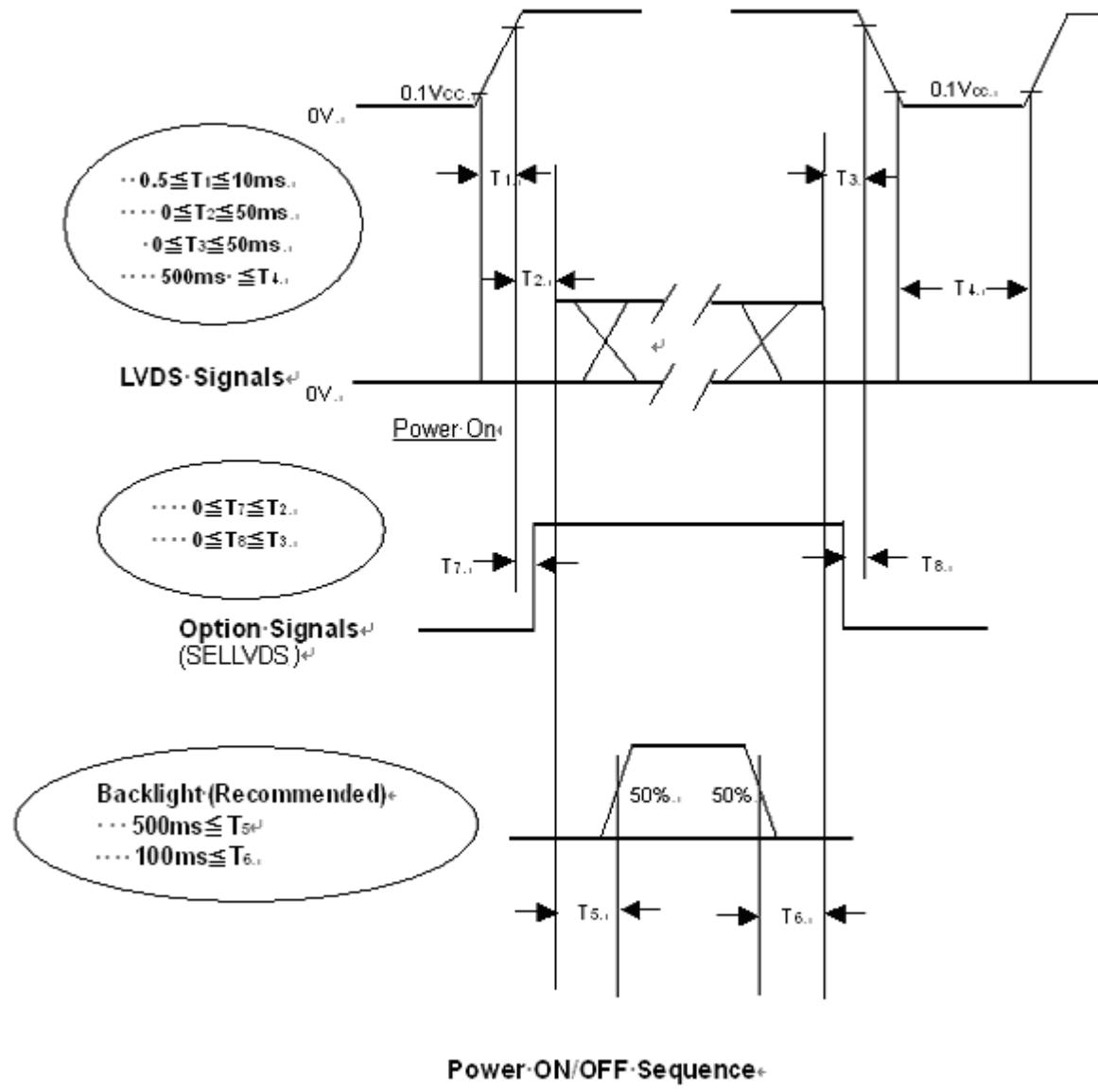
Note (6) Please fix the Vertical timing (Vertical Total = 1524 / Display = 1080 / Blank = 444) in 3D mode.

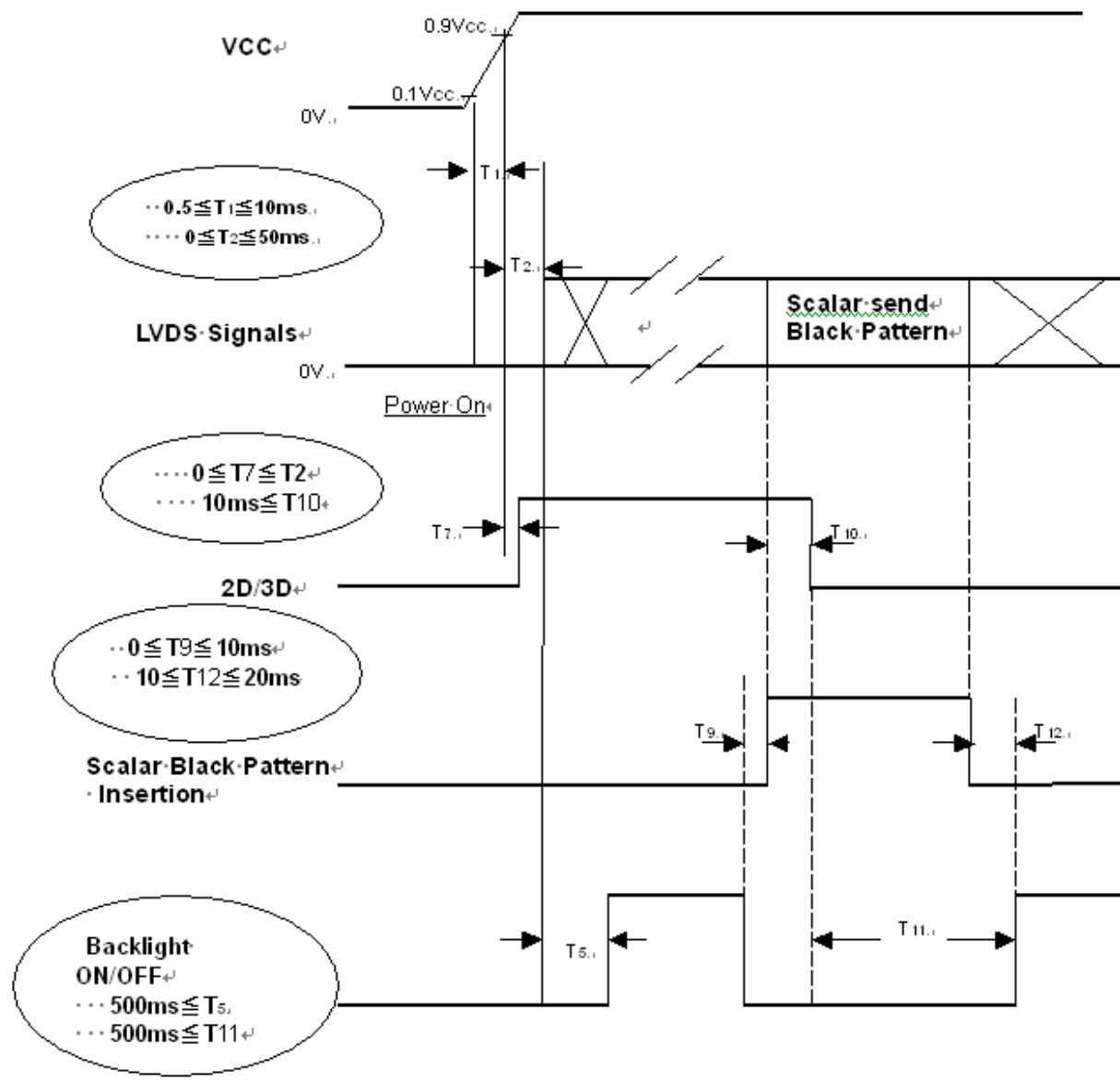
Note (7) Please fix the Horizontal timing (Horizontal Total = 2100 / Display = 1920 / Blank = 180) in 3D mode

4.6 POWER ON/OFF SEQUENCE

4.6.1 POWER ON/OFF SEQUENCE ($T_a = 25 \pm 2 {}^\circ C$)

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



4.6.2 2D to 3D SIGNAL SEQUENCE WITHOUT VCC TURN OFF AND TURN ON


Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the LED voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance. If $T_2 < 0$, that maybe cause electrical overstress failure.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

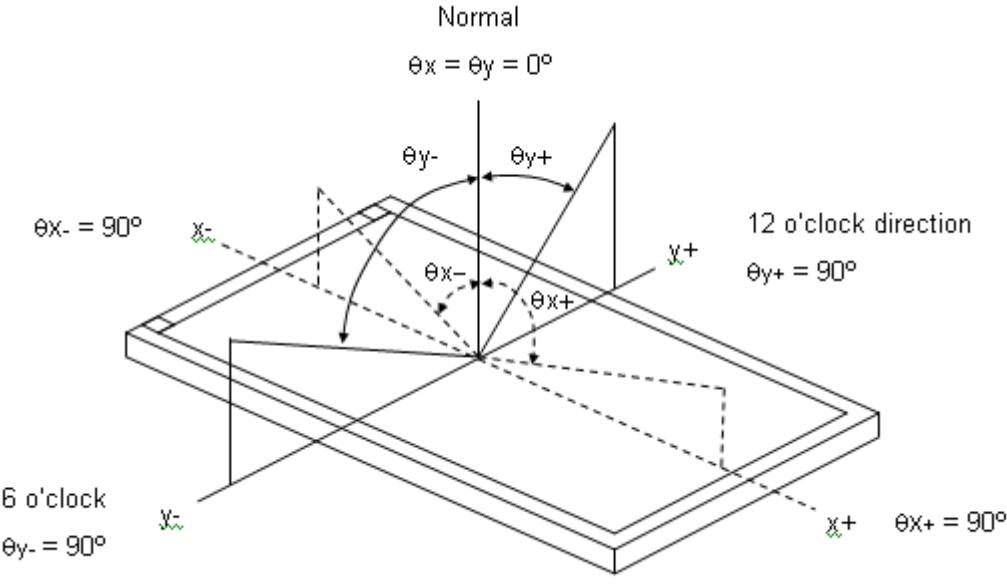
Item	Symbol	Value	Unit
Ambient Temperature	T _a	25±2	oC
Ambient Humidity	H _a	50±10	%RH
Supply Voltage	V _{CC}	12.6	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current Per Input Pin	I _{PIN}	40 ± 1.2	mADC
PWM Duty Ratio	D	100	%
LED Light Bar Test Converter	CMI 27-D041745		

5.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 5.2. The following items should be measured under the test conditions described in 5.1 and stable environment shown in Note (5).

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note		
Color Chromaticity (CIE 1931)	Red	$\theta_x=0^\circ, \theta_Y=0^\circ$ CS-2000 R=G=B=255 Gray scale	Typ - 0.03	0.641	Typ + 0.03	-	(1), (5)		
				0.339					
	Green			0.308					
				0.618					
	Blue			0.159					
				0.059					
	White			0.313					
				0.329					
Center Luminance of White (Center of Screen)	L _c		250	300	-	cd/m ²	(4), (5)		
Contrast Ratio	CR		700	1000	-	-	(2), (5)		
Response Time	T _R	$\theta_x=0^\circ, \theta_Y=0^\circ$	-	0.8	2.5	ms	(3)		
	T _F		-	2.6	5.5				
White Variation	W	$x=0, Y=0$	70	-	-	%	(5), (6)		
Viewing Angle	Horizontal	$CR \geq 10$	150	170	-	Deg.	(1), (5)		
	Vertical		140	160	-				
Viewing Angle	Horizontal	$CR \geq 5$	160	178	---	Deg.	(1), (5)		
	Vertical		150	170	---				

Note (1) Definition of Viewing Angle (θ_x, θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

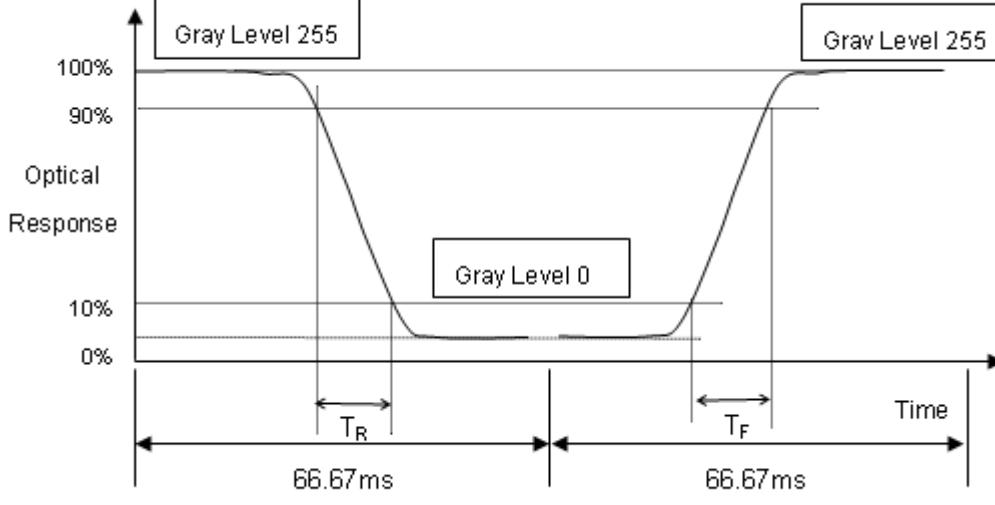
L255: Luminance of gray level 255

L₀: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R , T_F):



Note (4) Definition of Luminance of White (L_c):

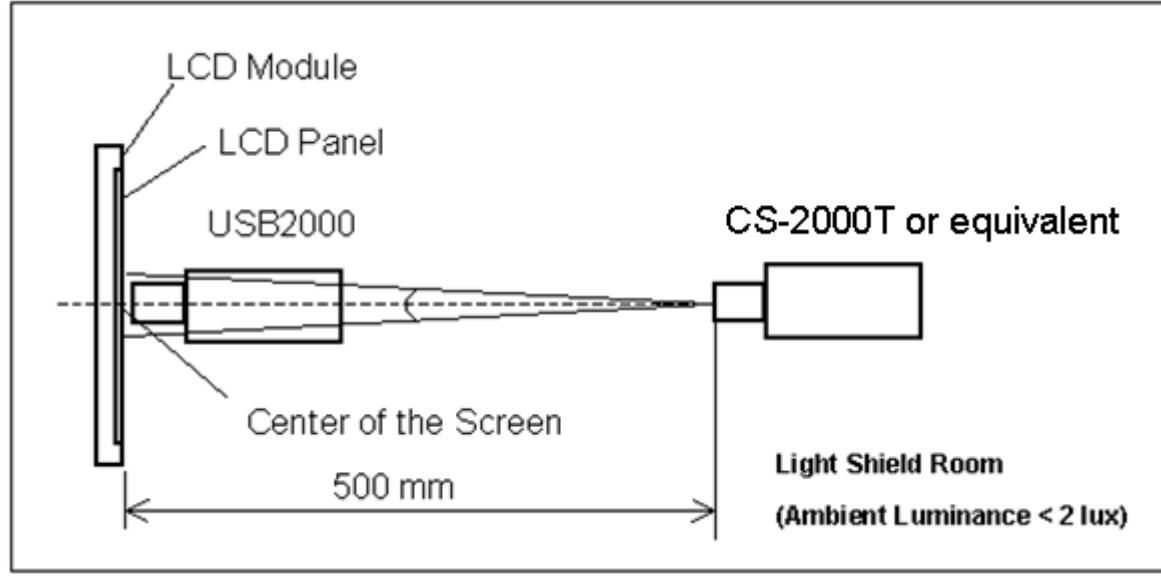
Measure the luminance of gray level 255 at center point

$$L_c = L(5)$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

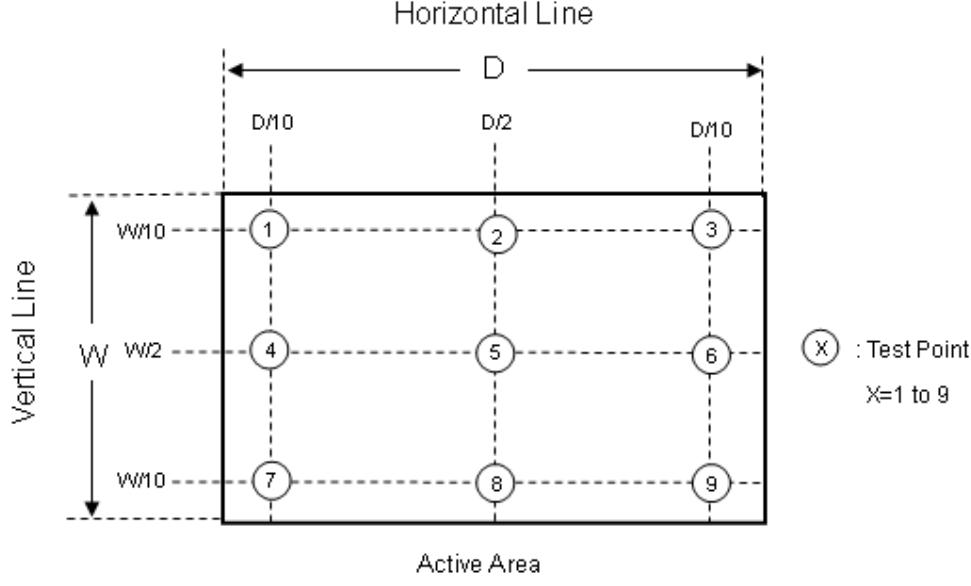
The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

$$\delta W = (\text{Minimum } [L(1) \sim L(9)] / \text{Maximum } [L(1) \sim L(9)]) * 100\%$$



6. RELIABILITY TEST ITEM

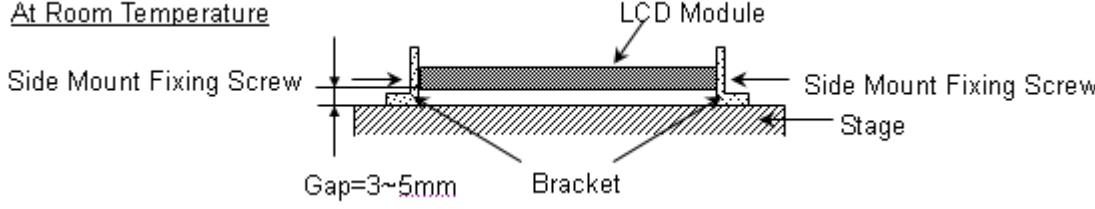
Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50°C , 80%RH, 240hours	
High Temperature Operation (HTO)	Ta= 50°C , 50%RH , 240hours	
Low Temperature Operation (LTO)	Ta= 0°C , 240hours	
High Temperature Storage (HTS)	Ta= 60°C , 240hours	
Low Temperature Storage (LTS)	Ta= -20°C , 240hours	
Vibration Test (Non-operation)	Acceleration: 1.5 Grms Wave: Half-sine Frequency: 10 - 300 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 11 ms Direction : ± X, ± Y, ± Z.(one time for each Axis)	
Thermal Shock Test (TST)	-20°C/30min , 60°C / 30min , 100 cycles	
On/Off Test	25°C ,On/10sec , Off /10sec , 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω)	
	Air Discharge: ± 15KV, 150pF(330Ω)	
Altitude Test	Operation:10,000 ft / 24hours Non-Operation:30,000 ft / 24hours	

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:



7. PACKING

7.1 PACKING SPECIFICATIONS

- (1) 7 LCD modules / 1 Box
- (2) Box dimensions: 720(L) X 360(W) X 480(H) mm
- (3) Weight: approximately: 25.83 Kg (7 modules per box)

7.2 PACKING METHOD

- (1) Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Pass
Dropping Test	1 Corner , 3 Edge, 6 Face, 31cm	Pass

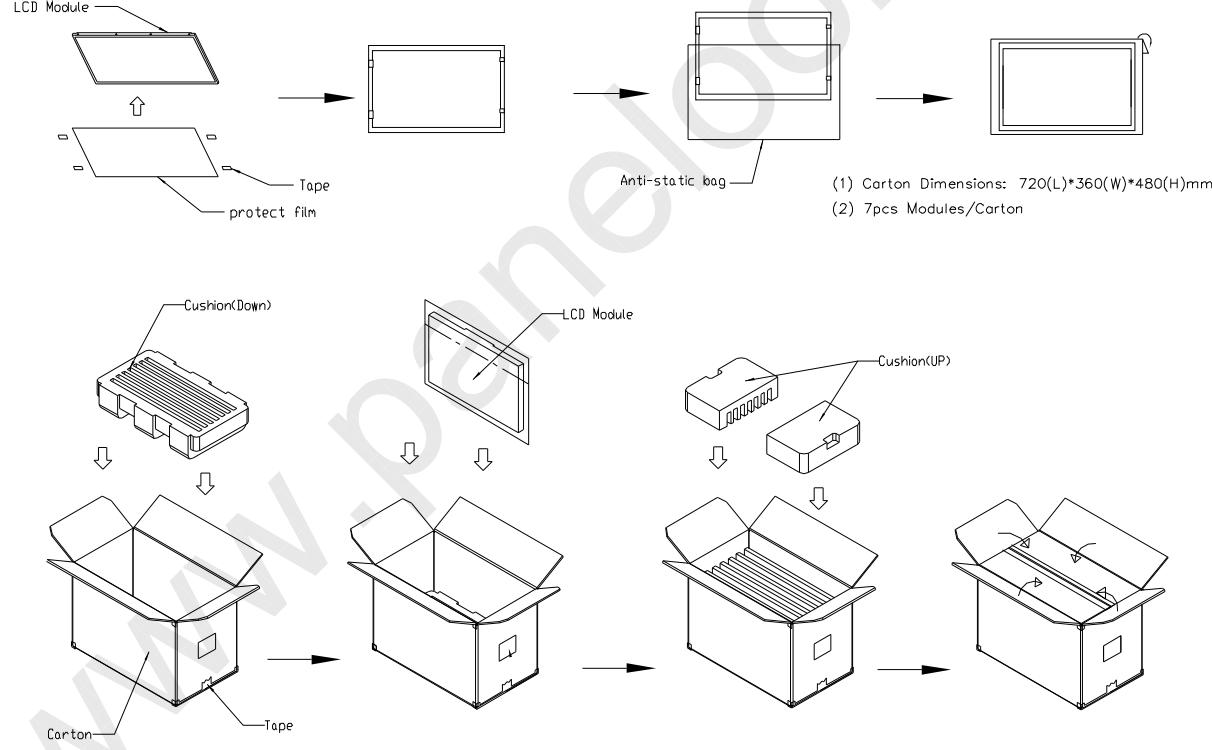
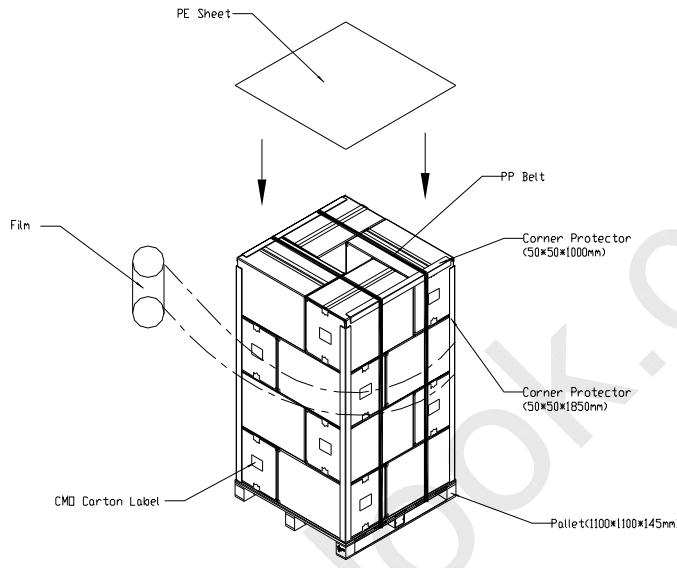


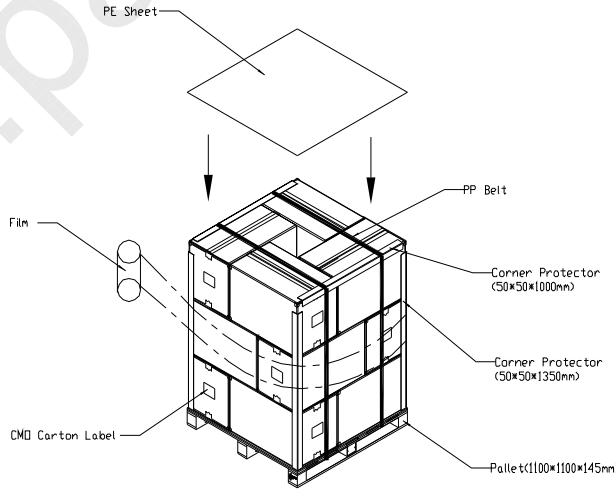
Figure. 7-1 Packing method

7.3 PALLET

Sea and land transportation

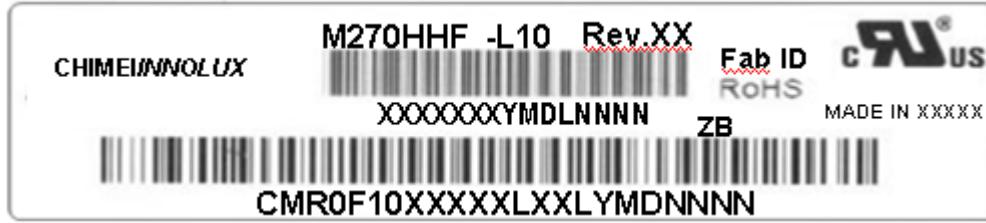


Air transportation

**Figure. 7-2 Packing method**

8. CMI MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: M270HHF-L10
- (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.
- (c) CMI barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

Code	Meaning	Description
XX	CMI internal use	-
XX	Revision	Cover all the change
X	CMI internal use	-
XX	CMI internal use	-
YMD	Year, month, day	Year: 0~9, 2001=1, 2002=2, 2003=3...2010=0, 2011=1, 2012=2... Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U.
L	Product line #	Line 1=1, Line 2=2, Line 3=3, ...
NNNN	Serial number	Manufacturing sequence of product

- (d) Customer's barcode definition:

Serial ID: CM-R0F10-X-X-X-XX-L-XX-L-YMD-NNNN

Code	Meaning	Description
CM	Supplier code	CMI=CM
R0F10	Model number	M270HHF-L10= R0F10
X	Revision code	Non ZBD: 1,2,~,8,9 / ZBD: A~Z
X	Source driver IC code	Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatec=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M, ILITEK=Q, Fiti=Y, None IC=Z
X	Gate driver IC code	Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatec=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M, ILITEK=Q, Fiti=Y, None IC=Z
XX	Cell location	Tainan Taiwan=TN, Ningbo China=CN, Hsinchu Taiwan=SC
L	Cell line #	1,2,~,9,A,B,~,Y,Z
XX	Module location	Tainan, Taiwan=TN ; Ningbo China=NP, Shenzhen China=SH
L	Module line #	1,2,~,9,A,B,~,Y,Z
YMD	Year, month, day	Year: 0~9, 2001=1, 2002=2, 2003=3...2010=0, 2011=1, 2012=2... Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, T, U, V
NNNN	Serial number	By LCD supplier

(e) FAB ID(UL Factory ID):

Region	Factory ID
TWCMI	GEMN
NBCMI	LEOO
NBCME	CANO
NHCMI	CAPG

9. PRECAUTIONS

9.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly.

9.2 STORAGE PRECAUTIONS

- (1) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0°C to 35°C and relative humidity of less than 70%
- (2) Do not store the TFT – LCD module in direct sunlight
- (3) The module should be stored in dark place. It is prohibited to apply sunlight or fluorescent light in storing

9.3 OPERATION PRECAUTIONS

- (1) The LCD product should be operated under normal condition.

Normal condition is defined as below :

Temperature : 20±15°C

Humidity: 65±20%

Display pattern : continually changing pattern(Not stationary)

(2) If the product will be used in extreme conditions such as high temperature, high humidity, high altitude ,display pattern or operation time etc...It is strongly recommended to contact CMI for application engineering advice . Otherwise, Its reliability and function may not be guaranteed.

9.4 SAFETY PRECAUTIONS

- (1) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the module's end of life, it is not harmful in case of normal operation and storage.

9.5 SAFETY STANDARDS

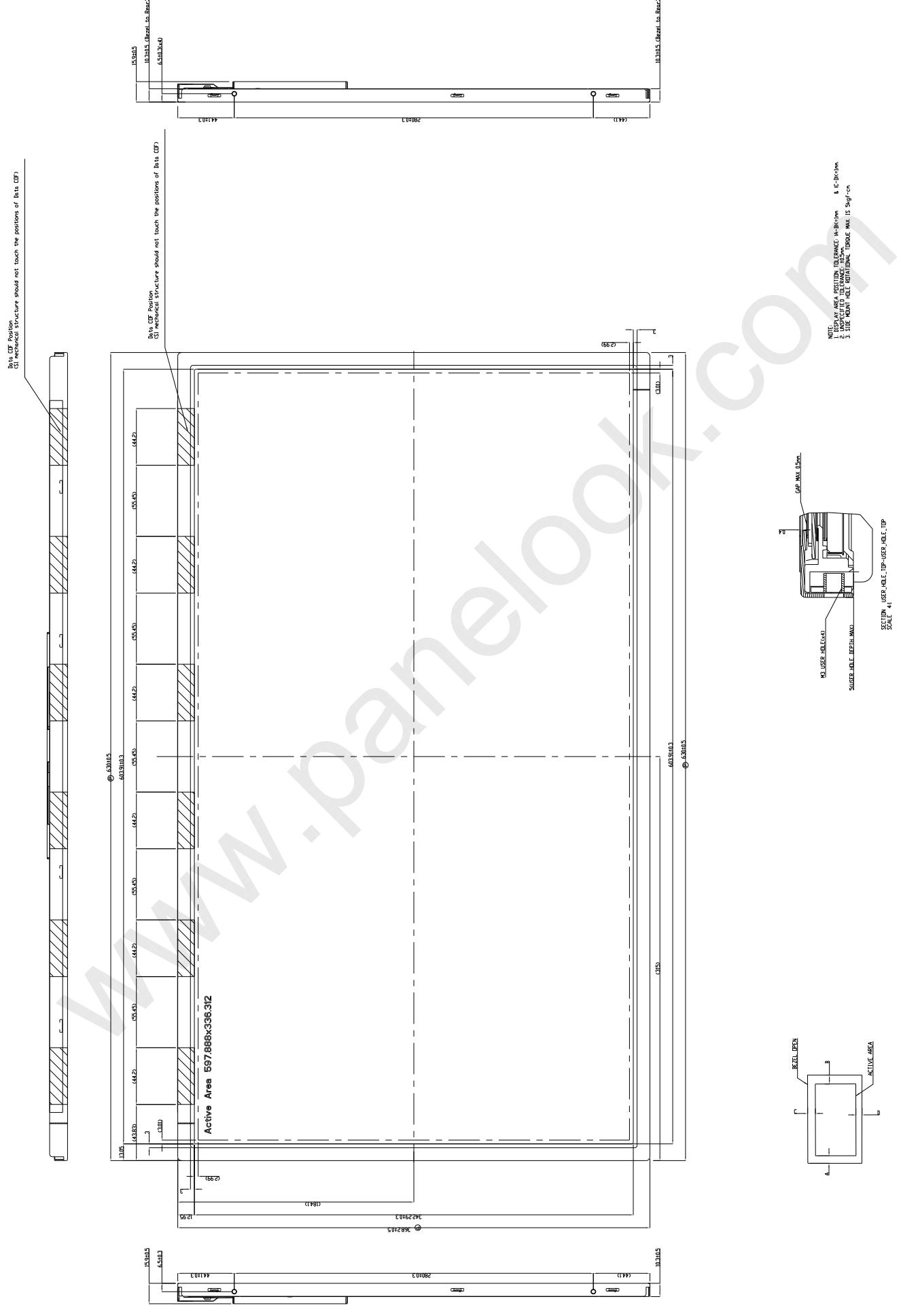
The LCD module should be certified with safety regulations as follows:

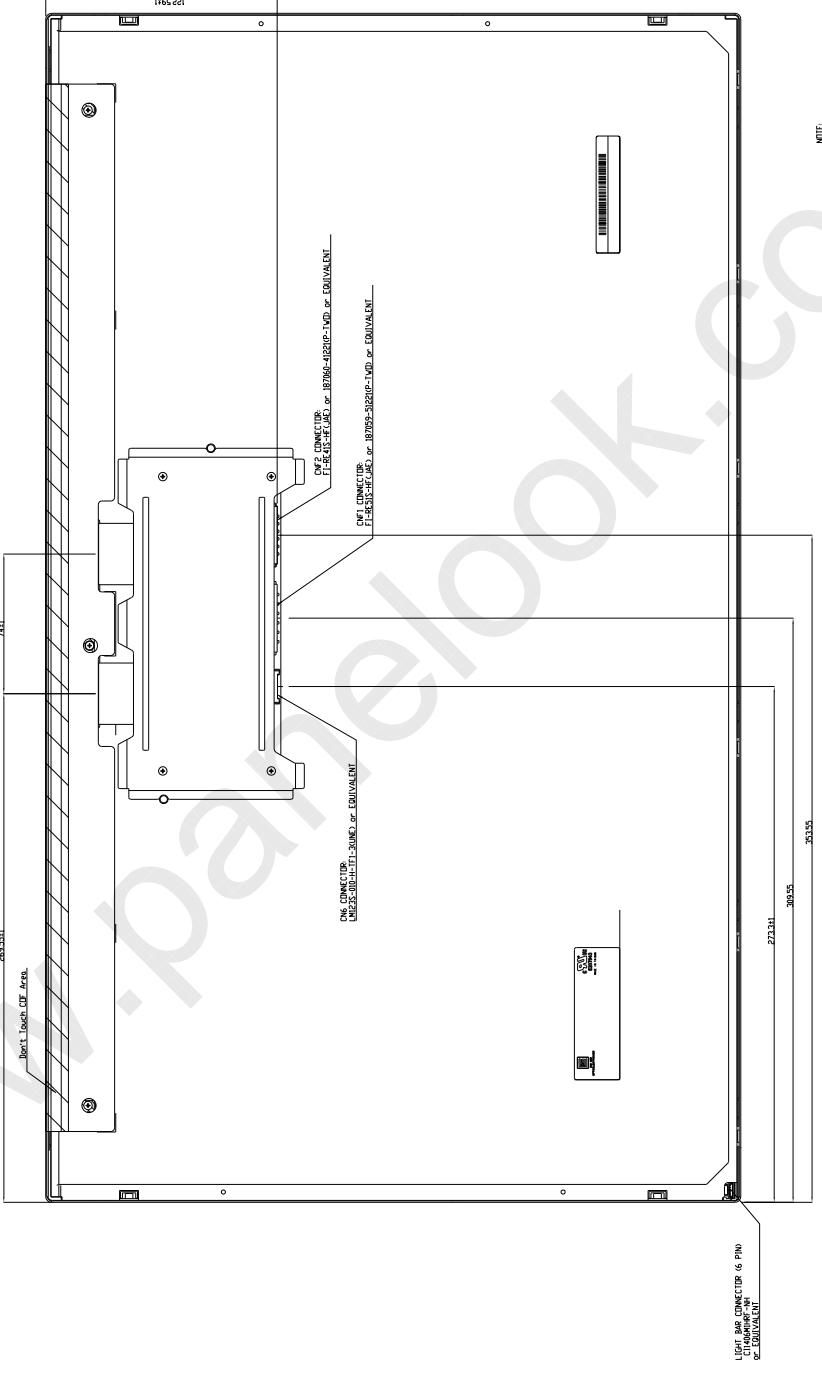
Requirement	Standard	remark
UL	UL60950-1:2006 or Ed.2:2007	
cUL/CSA	CAN/CSA C22.2 No.60950-1-03 or 60950-1-07	
CB	IEC60950-1:2005 / EN60950-1:2006+ A11:2009	

9.6 OTHER

When fixed patterns are displayed for a long time, remnant image is likely to occur.

Appendix. OUTLINE DRAWING





NOTE:
 1. DISPLAY AREA POSITION TOLERANCE: $1a - B \leq 1mm$
 2. UNSPECIFIED TOLERANCE: $\pm 0.5mm$.
 3. SIDE MOUNT HOLE ROTATIONAL TORQUE MAX. IS $5kgf\cdot cm$.